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## PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional)

8028-42 (SPX200304-0017US)

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on August 16, 2006

Signature 

Typed or printed name Scott L. Appelbaum

Application Number

10/787,368

Filed

February 26, 2004

First Named Inventor

Hyun-Woo KIM et al.

Art Unit

7152

Examiner

Amanda C. Walke

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).

Note: No more than five (5) pages may be provided.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest.  
See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed.  
(Form PTO/SB/96)

☒ attorney or agent of record. 41,587  
Registration number

☐ attorney or agent acting under 37 CFR 1.34.

Registration number if acting under 37 CFR 1.34 \_\_\_\_\_

  
Signature

Scott L. Appelbaum

Typed or printed name

516-692-8888

Telephone number

August 16, 2006

Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required.  
Submit multiple forms if more than one signature is required, see below\*.

☐ \*Total of \_\_\_\_\_ forms are submitted.

This collection of information is required by 35 U.S.C. 132. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11, 1.14 and 41.6. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

APPLICANTS: Hyun-Woo Kim, et al. EXAMINER: Amanda C. Walke  
SERIAL NO.: 10/787,368 GROUP ART UNIT: 1752  
FILED : February 26, 2004  
FOR: **METHOD OF FORMING AN UNDERLAYER OF A  
BILAYER RESIST FILM AND METHOD OF  
FABRICATING A SEMICONDUCTOR DEVICE USING  
THE SAME**

Mail Stop AF  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

**PRE-APPEAL BRIEF REQUEST FOR REVIEW**

Sir:

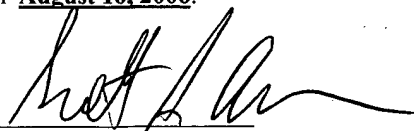
This paper is being filed in support of the Notice of Appeal filed being filed together herewith with the United States Patent and Trademark Office.

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**CERTIFICATE OF MAILING 37 C.F.R. § 1.8(a)**

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Dated: August 16, 2006



Scott L. Appelbaum

**REMARKS**

Please consider the following reasons for this Pre-Appeal Brief Request For Review.

Claims 1, 3-5, 10-16, 21-33 and 35-37 are pending and stand rejected in the above-referenced application.

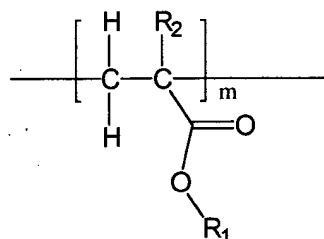
**(i) Claims 1, 3-5, 11-16, 22-33 and 35-37 stand rejected as being unpatentable over U.S. Patent No. 6,054,248 to Foster et al. ("the Foster patent") in view of U.S. Patent No. 4,276,136 to Gruber et al. ("the Gruber patent"), U.S. Patent No. 6,261,687 to Ryang et al. ("the Ryang patent") or U.S. Patent Application Publication No. 2004/0009428 to Tamura et al. ("the Tamura patent") in view of U.S. Patent No. 6,146,793 to Schaedeli et al. ("the Schaedeli patent").**

**(ii) Claims 10 and 21 have been rejected as being unpatentable over Foster in view of Ryang, Gruber or Tamura in view of U.S. Patent No. 6,319,655 to Wong et al. ("the Wong patent").**

**Claims 1 and 24**

**Claim 1 reads as follows:**

A method of forming an underlayer of a bi-layer resist film, comprising:  
forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein, R<sub>1</sub> is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a

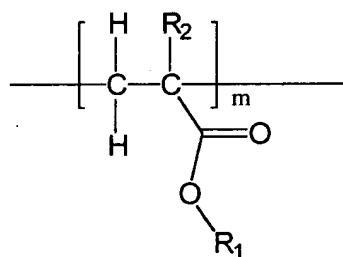
lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms,  $R_2$  is a hydrogen or a methyl group, and  $m$  is an integer ranging from 10 to 500;

coating a substrate with the blended material; and

irradiating the blended material coated on the substrate with an e-beam to form said underlayer, and wherein the polymer having the aromatic group is a novolac polymer or a naphthalene polymer.

**Claim 24 reads as follows:**

A method of forming a semiconductor device using a bi-layer resist, comprising:  
forming a blended material by blending a polymer having an aromatic group and a methacrylate polymer represented by the following chemical formula:



wherein,  $R_1$  is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms,  $R_2$  is a hydrogen or a methyl group, and  $m$  is an integer ranging from 10 to 500;

coating a substrate with the blended material;

forming an underlayer by irradiating the blended material coated on the substrate with an e-beam;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask, and wherein the polymer having the aromatic group is a novolac polymer or a naphthalene polymer.

The combination of Foster, Gruber, Ryang, Tamura and Schaedeli fails to teach or suggest a method which includes forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam, and wherein the blended material includes a novolac polymer or a naphthalene polymer blended with a methacrylate polymer, represented by the chemical formula as essentially recited in claims 1 and 24.

In the May 16, 2006 Final Office Action, the Examiner maintains that:

Although Foster fails to teach irradiating a blended material with an e-beam to form an underlayer of a bilayer resist, that Gruber, Ryang, and Tamura all teach e-beam curing similar curable compositions to those of Foster. Furthermore, the Examiner alleges that given the teachings of the Foster reference which, according to the Examiner clearly discloses polymers meeting the instant claim limitations employed in an undercoat for a bilayer resist and a method of forming a pattern using the same as described by the instant invention, it would have been obvious to one of ordinary skill in the art to prepare the material of Foster choosing to employ an e-beam to cure a thermally curable underlayer given it is taught to be conventional by Tamura, Ryang and Gruber.

**See May 16, 2006 Final Office Action, Pages 8 and 9.**

However, Applicants respectfully submit that the Examiner committed clear error in the above-mentioned Final Office Action in concluding that the combination of Foster, Gruber, Ryang, Tamura and Schaedeli teaches a method which includes forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam, and wherein the blended material includes a novolac polymer or a naphthalene polymer blended with a methacrylate polymer, as essentially recited in claims 1 and 24.

In contrast, the combined teachings of Foster, Gruber, Ryang, Tamura and Schaedeli would not yield a method which included forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam, and wherein the blended material included a novaloc polymer or a naphthalene polymer blended with a methacrylate polymer because at the very least (i) Foster expressly teaches away from using novolac resins in forming its underlayer and in addition (ii) Foster, Gruber, Ryang, Tamura and Schaedeli each at the very least fail to teach or suggest the feature of e-beaming a blended material which includes a naphthalene polymer blended with a methacrylate polymer, represented by the specific chemical formula as essentially recited in claims 1 and 24. Each of these reasons will be discussed below.

Although Foster mentions novolac resins, Foster expressly teaches away from their use. For example, Foster discusses what it perceives to be disadvantages associated with using novolac resins. (See Col. 1, lines 46-55 of Foster). Instead, Foster seeks to provide an undercoat which has an etch rate comparable to novolac resins, but which do not include novolac resins. In contrast, Foster provides a voluminous laundry list of other possible compounds (excluding novolac resins) which may be used in forming its undercoat layer. (See Col. 2, lines 63-67 and Cols. 3-5 of Foster). In other words, it is clearly an objective of Foster to avoid the use of novolac resins in forming its underlayer.

The teachings of Foster thus clearly discourage and teach away from using novolac resins in forming underlayers of bilayer resist systems. Furthermore, it is well known that under the U.S. patent laws, when a prior art reference or references teaches away or leads away from a claimed invention, obviousness may be rebutted. (See MPEP 2145). Accordingly, one skilled in the art would not modify the primary reference of Foster as proposed in the instant Office Action to include novolac resins due to the fact that Foster as discussed above expressly teaches away from doing so. Consequently, even if Foster, Gruber, Ryang, Tamura and Schaedeli were combined, this proposed combination would still at the very least fail to teach or suggest the feature of e-beaming a blended material which includes a novaloc polymer blended with a methacrylate

polymer, represented by the chemical formula of claims 1 and 24 to form an underlayer of a bilayer resist, as essentially recited in claims 1 and 24.

Furthermore, Foster, Gruber, Ryang, Tamura and Schaedeli also at the very least fail to teach or suggest the feature of e-beaming a blended material which includes a naphthalene polymer blended with a methacrylate polymer, represented by the chemical formula of claims 1 and 24 to form an underlayer of a bilayer resist, as essentially recited in claims 1 and 24. In contrast, Foster, Gruber, Ryang, Tamura and Schaedeli are each completely silent regarding the feature of e-beaming a blended material which includes a naphthalene polymer blended with a methacrylate polymer, represented by the specific chemical formula as essentially recited in claims 1 and 24.

Moreover, it would not have been obvious to one skilled in the art to provide the feature of e-beaming a blended material which includes a naphthalene polymer blended with a methacrylate polymer, of the specific chemical formula as essentially recited in claims 1 and 24 for at least the reasons set forth below. In particular, the teachings of Foster, Gruber, Ryang, Tamura and Schaedeli each fail to provide sufficient motivation for doing so. As is well known under the U.S. patent laws, in order to modify a reference, there must be some teaching in the art regarding the desirability of doing so. (See MPEP 2143.01) However, the Foster, Gruber, Ryang, Tamura and Schaedeli references each fail to provide such a desirability or teaching. Rather, Foster, Gruber, Ryang, Tamura and Schaedeli each simply provide a voluminous laundry list of possible compounds to choose from in forming their respective coatings, without any hint or suggestion as to the desirability of choosing a blended material which includes a naphthalene polymer blended with a methacrylate polymer, of the specific chemical formula as essentially recited in claims 1 and 24. Furthermore, it is also a well established fact in the field of U.S. patent law that the chemical art is an unpredictable art. (See *In re Marzocchi*, 439 F.2d 220, 223-24, 169 USPQ 367, 368-70 (CCPA 1971) and 2164.03 of the MPEP) Therefore, due to the unpredictability of chemical compounds and chemical reactions, it would not have

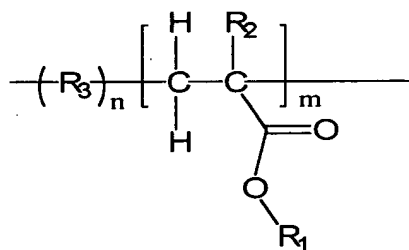
been obvious to one skilled in the art to provide e-beaming a blended material which includes a naphthalene polymer blended with a methacrylate polymer, of the specific chemical formula to form an underlayer of a bilayer resist as essentially recited in claims 1 and 24 with a reasonable expectation of success.

Accordingly, for at least the reasons discussed above, there are clear errors in the Examiner's rejections of claim 1 and 24 based upon the combination of Foster, Gruber, Ryang, Tamura and Schaedeli with respect to a method which includes forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam, and wherein the blended material includes a novaloc polymer or a naphthalene polymer blended with a methacrylate polymer, as essentially recited in claims 1 and 24.

### **CLAIMS 13, 29 AND 35**

**Claim 13 reads as follows:**

A method of forming a underlayer of a bi-layer resist film, comprising:  
preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:



wherein,  $R_1$  is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms,  $R_2$  is a hydrogen or a methyl group,  $R_3$  is a monomer having an aromatic group, and each of  $m$  and  $n$  is an integer ranging from 10 to 500;

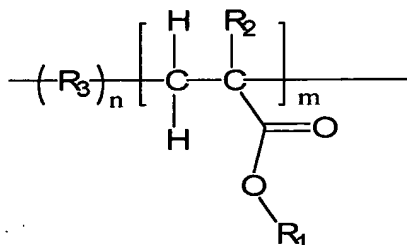
coating a substrate with the prepared material; and



irradiating the prepared material coated on the substrate with an e-beam to form said underlayer and, wherein the copolymer is a copolymer having styrene and methacrylate monomers.

**Claim 29 reads as follows:**

A method of forming a semiconductor device using a bi-layer resist, comprising:  
 preparing a material including a copolymer having a monomer with an aromatic group and a methacrylate monomer, the copolymer represented by the following chemical formula:



wherein, R<sub>1</sub> is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R<sub>2</sub> is a hydrogen or a methyl group, R<sub>3</sub> is a monomer having an aromatic group, and each of m and n is an integer ranging from 10 to 500;

coating a substrate with the prepared material;

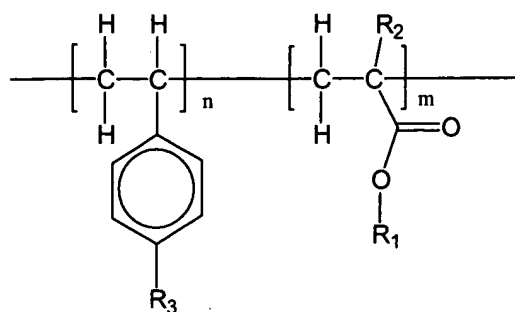
forming an underlayer by irradiating the prepared material coated on the substrate with an e-beam;

forming a toplayer over the underlayer;

forming a toplayer pattern in the toplayer;

forming an underlayer pattern by etching the underlayer using the toplayer pattern as an etch mask; and

etching the substrate using the underlayer pattern as an etch mask and, wherein the copolymer is a copolymer having styrene and methacrylate monomers, the copolymer is represented by the following chemical formula:

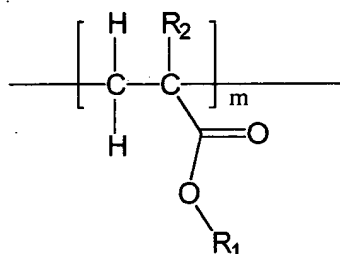


wherein, R<sub>1</sub> is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic acid of 1 to 15 carbon atoms, R<sub>2</sub> is a hydrogen or a methyl group, R<sub>3</sub> is one selected from a group consisting of hydrogen, a hydroxyl group, a chlorine and a bromine, and each of m and n is an integer ranging from 10 to 500.

**Claim 35 reads as follows:**

A method of forming an underlayer of a bi-layer resist film, comprising:

forming a blended material by blending a polymer having an aromatic group  
and a methacrylate polymer represented by the following chemical formula:



wherein, R<sub>1</sub> is one selected from a group consisting of an aromatic compound, a hydrocarbon of 1 to 5 carbon atoms, an aliphatic hydrocarbon of 1 to 15 carbon atoms, a lactone of 1 to 15 carbon atoms, an ether of 1 to 15 carbon atoms and a carboxylic

acid of 1 to 15 carbon atoms,  $R_2$  is a hydrogen or a methyl group, and  $m$  is an integer ranging from 10 to 500;

coating a substrate with the blended material; and

irradiating said blended material on a substrate with an e-beam to cause a cross-linking reaction wherein the methacrylate polymer of the blending material becomes cross-linked, thereby forming said underlayer.

In addition, it is respectfully submitted that the Examiner has also committed clear error in the above-mentioned Final Office Action in rejecting claims 13, 29 and 35 by concluding that there is sufficient motivation for one skilled in the art to combine Foster, Gruber, Ryang, Tamura and Schaedeli by modifying the process of Foster to e-beam cure the polymers of Foster using the e-beaming processes described in Gruber, Ryang, Tamura and/or Schaedeli. Rather, the Examiner has failed to provide sufficient motivation for making the above combination. As is well known under the U.S. Patent Laws, the Examiner bears the initial burden of establishing a prima facie conclusion of obviousness. (See MPEP 2142).

In particular, the Examiner has failed to meet the above burden because the motivation asserted by Examiner in the instant Office Action that it would have been obvious to employ an e-beam to cure the thermally curable underlayer of Foster because Gruber, Ryang, Tamura each teach it is conventionally known to do so is clearly erroneous. The above statement is erroneous, because although these references discuss photosensitive compositions, none of the compositions or methods described in Gruber, Ryang, Tamura even relate to e-beaming a coating to form an underlayer of a bilayer resist. In other words, the e-beams described Gruber, Ryang, Tamura are not used to form an underlayer of a bilayer resist. Furthermore, the Foster reference has very specific process conditions (e.g. temperature and time conditions) that it requires for forming its under layer and the Examiner sets forth insufficient

motivation or desire as to why to one skilled in the art would alter these required process conditions set forth in Foster to include an e-beam curing method. (See Col. 2, lines 49-63 of Foster).

Thus, the motivation provided by the Examiner in the instant Office Action is nothing more than conclusory and is therefore insufficient for establishing the requisite motivation for making the combination proposed set forth in the instant Office Action. Accordingly, for at least the reasons discussed above, there are clear errors in the Examiner's rejections of claims 13, 29 and 35 based the requisite motivation needed to combine Foster, Gruber, Ryang, Tamura and Schaedeli for teaching a method which includes forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam.

#### **CLAIMS 10 AND 21**

##### **Claim 10 reads as follows:**

The method according to claim 1, wherein the e-beam has energy of about 0.1 mC/cm<sup>2</sup> to about 100 mC/cm<sup>2</sup>.

##### **Claim 21 reads as follows:**

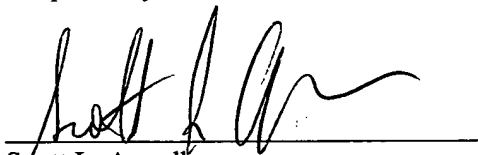
The method according to claim 13, wherein the e-beam has energy of about 0.1 mC/cm<sup>2</sup> to about 100 mC/cm<sup>2</sup>.

Lastly, there are also clear errors in Examiner's rejections of claims 10 and 21. Claims 10 and 21 depend from claims 1 and 13, respectively. As discussed above, Foster, Gruber, Ryang, Tamura, Schaedeli fail to teach or suggest a method which includes forming an underlayer of a bilayer resist system by irradiating a blend material with an e-beam, and wherein the blend material includes a novaloc polymer

or a naphthalene polymer blended with a methacrylate polymer, represented by the chemical formula as essentially recited in claim 1. The Wong reference clearly fails to cure the above deficiencies of Foster, Gruber, Ryang, Tamura, Schaedeli because Wong at the very least also fails to teach or suggest a method which includes forming an underlayer of a bilayer resist system by irradiating a blended material with an e-beam, and wherein the blended material includes a novaloc polymer or a naphthalene polymer blended with a methacrylate polymer, represented by the chemical formula as essentially recited in claim 1. Moreover, as discussed above with regard to claim 13, there is insufficient motivation provided on the record for combining Foster, Gruber, Ryang, Tamura, Schaedeli and Wong in the manner proposed in the Final Office Action. Thus, there are also clear errors in Examiner's rejections with regard to claims 10 and 21.

As such, based on the above-mentioned clear errors with regard to claims 1, 10, 13, 21, 24, 29 and 35, an early and favorable reconsideration is earnestly solicited.

Respectfully submitted,



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